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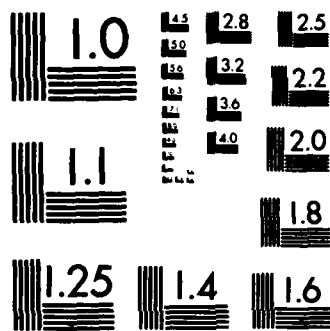
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ARMY LIBRARY CONVERSION: COST ASSESSMENT PLAN



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1.0 INTRODUCTION

The Lister Hill National Center for Biomedical Communications as the research and development arm of the National Library of Medicine is developing a minicomputer-based Integrated Library System (ILS) for use in medium-sized libraries. The ILS is being designed in modules roughly corresponding to a library's subsystem; these include circulation, acquisitions, reference, etc. The development of the circulation module is currently being completed and will be installed at the Pentagon Army Library in 1979.

The Lister Hill project has been concerned not only with the design of the ILS but also with the cost of installing and operating it. The center has sponsored a cost analysis of the Army Library's existing manual circulation system. It has also contracted for collection of conversion cost information from which operating costs may also be derived. This cost information will be used to develop a model to aid librarians in predicting the cost of installing and operating the ILS in their institutions.

The MITRE Corporation has been tasked to plan and monitor the conversion of the Army Library's manual circulation system to the ILS. This includes an analysis of data entry procedures and error rates as well as the collection of cost data on conversion.

1.1 Scope and Purpose of this Report

This report is not a cost study. Rather, it outlines the procedures to be followed in determining conversion costs at the

Army Library. As a work plan, it identifies the conversion activities to be studied, discusses the costs involved (labor, equipment and materials), and presents a method of collecting cost data.

1.2 Assumptions

The development of this plan for assessing costs is based on several assumptions. First, only economic, not social costs, will be considered. Secondly, only costable, accountable components of a process will be studied. And lastly, the analysis will focus on unit costs for processing specific types of items, rather than a total conversion cost. Each of these assumptions is discussed in greater detail below.

The literature of cost/benefit analysis has been concerned with measuring social costs such as a reader's failure to find items he seeks. During a conversion period, items will be withdrawn from circulation for the time it takes to create bibliographic and activity records, and to produce labels for the item. There is no attempt in this report to assign a dollar value to the time an item is unavailable for patron use.

In costing the various activities involved in conversion, it is possible to break down each process into a number of discrete steps and to collect cost information on each component. However, as Douglas Price has pointed out, the cost of collecting data in

detail can exceed the value of the information derived.¹ Thus the first task must be to determine those discrete steps where costs can be isolated and those that must be aggregated either because they cannot be broken down for costing or because the value of doing so is minimal.

Lastly, costs reported to Lister Hill will be expressed in terms of unit costs, that is, what does it cost to enter a single activity record or to create a barcoded label. Unit costs are traditionally reported by library researchers to facilitate comparison; however, such costs can be misleading. This is true partly because the "units" processed by a library are not analogous to cars on an assembly line; there are differences in complexity even within a medium such as periodicals. Then too, libraries cannot maintain a uniform level of productivity; fixed costs for salaries and equipment can raise unit costs in periods when there are few items to process. This cost assessment plan compensates for this by distinguishing among the units processed by complexity and by ensuring that the period sampled reflects the average traffic for processing and is neither an abnormally busy nor slack period.

¹Douglas Price. "Cost Analysis and Reporting as a Basis for Decisions" in Clinic On Library Applications of Data Processing, 13th University of Illinois, 1976. edited by J. L. Divilbiss. (Urbana-Champaign, Illinois: University of Illinois, Graduate School of Library Science, 1977.), p. 94.

1.3 Organization of this Report

This paper identifies conversion activities, separating them from the normal day-to-day operation of the system. Chapter 2.0 identifies which activities will be studied and to what level of detail. Chapter 3.0 is concerned with measurement of costs of equipment, materials and labor. Since accurate information on the amount of staff time required for conversion is needed, Chapter 4.0 describes the data collection, and Chapter 5.0 discusses factors that may modify or influence results. The final chapter summarizes the important aspects of the proposed study including the content of the weekly and final report.

2.0 IDENTIFICATION OF CONVERSION ACTIVITIES

The first step in determining conversion costs is to identify conversion activities, to break down these activities into their component parts, and to decide which components should be treated separately and which should be aggregated. This task is not as simple as it might seem. One problem is to separate the conversion activities from development and day-to-day operations. This is particularly a problem when conversion occurs simultaneously with full operation. The second problem is to decide on the level of detail required. Each of these is discussed below.

2.1 Separating Conversion From Operations

The Army Library will not complete the conversion of its data base before the circulation module is operational. Furthermore, the decision to label all items in the collection, including cataloged and non-circulating items, means that retrospective conversion is planned over a period of several years. The Conversion Plan for the Army Library (MTR-8032) identifies three phases of conversion: Phase 1 - Preparation Before the System Is Up, Phase 2 - Day-to-Day Operations, and Phase 3 - Retrospective Conversion. Retrospective conversion can be further defined as the creation of records and labeling of items in the library that have not and would not be expected to circulate. Phase 2 and Phase 3 activities will overlap.

Table I, Summary of Conversion Activity, shows the tasks for each phase of conversion. However, not every activity listed on the chart will be studied for the cost analysis. For example, equipment and site

TABLE I
SUMMARY OF CONVERSION ACTIVITY

TASKS DURING CONVERSION			
	Phase 1 - Preparation	Phase 2 - Day-Tu-Day	Phase 3 - Retrospective
Equipment & Site Preparation	Phone Lines to NIM Purchase Hewlett-Packard Terminal Purchase Barcode Printer Purchase Light Pens Purchase Card Stock, Label Tape Prepare Computer Room Rearrange Furniture in Circulation Area, Periodicals, and Cataloging Sections		
Building Data Base			
a) Patron Records	File in Compliance with Privacy Act Design Registration Forms Input Patron Records	Input New Patron Records Renew Patron Cards Replace Lost Cards	Create Records for Non-Circulating Monographs Create Activity Records for Bound Periodicals Items with Bibliographic Record Items Catalogued in Retrospective Conversion (Inc. Reference)
b) Monographs	Process OCLC Archival Tapes Process Weekly Cataloging Tapes	Process Weekly Cataloging Tapes Create Records for Circulating Items	
c) Serials	Upgrade Library Serials Tape	Begin Serial Check-in, Bound Periodicals as They Circulate	
d) Activity Records (Other than Serials)	Before Printer Arrives - For Multi-Volume Sets Only After Printer - Circulating Items	Weekly OCLC Tapes Circulating Items	
Labels	Patron Cards Multi-volume Sets Circulation Items as They Are Checked-In	New Titles - New Patrons Circulating Items Periodical Issues	Bound Periodicals Reference All Remaining Items
Training	Visit To A Working System Demonstrations: Light Pen, Printer, Etc. Exercises Users Manual		

preparation will be excluded from conversion costs. The rationale for this is that capital expenditures are usually amortized over the expected life of the equipment and are not attributable to conversion as such. All the activities listed under "Building the Data Base" with the exception of compliance with Privacy Act would be included.

Phase 2 offers the most serious problems for cost analysis since day-to-day operations mesh with conversion. As a general rule, new acquisitions would be considered part of normal operations; this would be true for both books and incoming periodical issues. The creation of records for items returned from circulation, any special processing of unlabeled items, and all patron registration will be counted as conversion. Practically, all record creation will be treated as part of conversion.

Retrospective conversion includes all activities listed in column four of Table I. Since retrospective conversion may take over a year it will be necessary to develop a sample, determine unit costs for such items, and extrapolate from that.

2.2 Level of Detail Required

The flow chart in Figure 1 shows four steps in the creation of a patron card. Each box on that chart could be broken down into several steps. For example, entering a patron record requires the following actions:

- screening the form for completion
- checking the system for prior entry

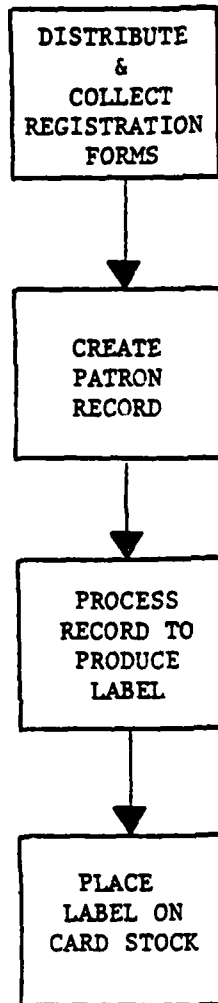


FIGURE 1
FLOWCHART SHOWING CREATION OF PATRON CARD

- entering the data and
- verifying the work file of patron records before processing.

Although the cost in terms of staff time could be ascertained for each step in the creation of a patron record, this will not be done.

The criteria for determining whether activities will be aggregated or considered separately are as follows:

- whether the activity is a discrete step or performed continuously within the work flow
- whether or not the cost of the activity can be measured, and
- whether or not measuring the cost of the activity would yield useful information.

Thus, in the example above, checking the system for prior entry is not a discrete step and would be aggregated with step three. Step one, the visual scanning of the registration form, requires so little time it probably cannot be measured. On the other hand, verification of the patron records is a time-consuming activity and may not be required if the error rate is low; therefore, it will be studied separately.

2.3 Description of Conversion Activities

In the following flowcharts (Figures 2 through 6) the activities selected for study have been enclosed in boxes to illustrate which activities will be studied separately and which will be aggregated. The flowcharts, with the exception of Figure 4 have been extracted from The Conversion Plan for the Army Library. Figure 4, which illustrates the OCLC/MARC Tape Processing, was adapted from the Integrated Library System--Design Note 8 (a LHNCBC- publication), dated 10/20/78.

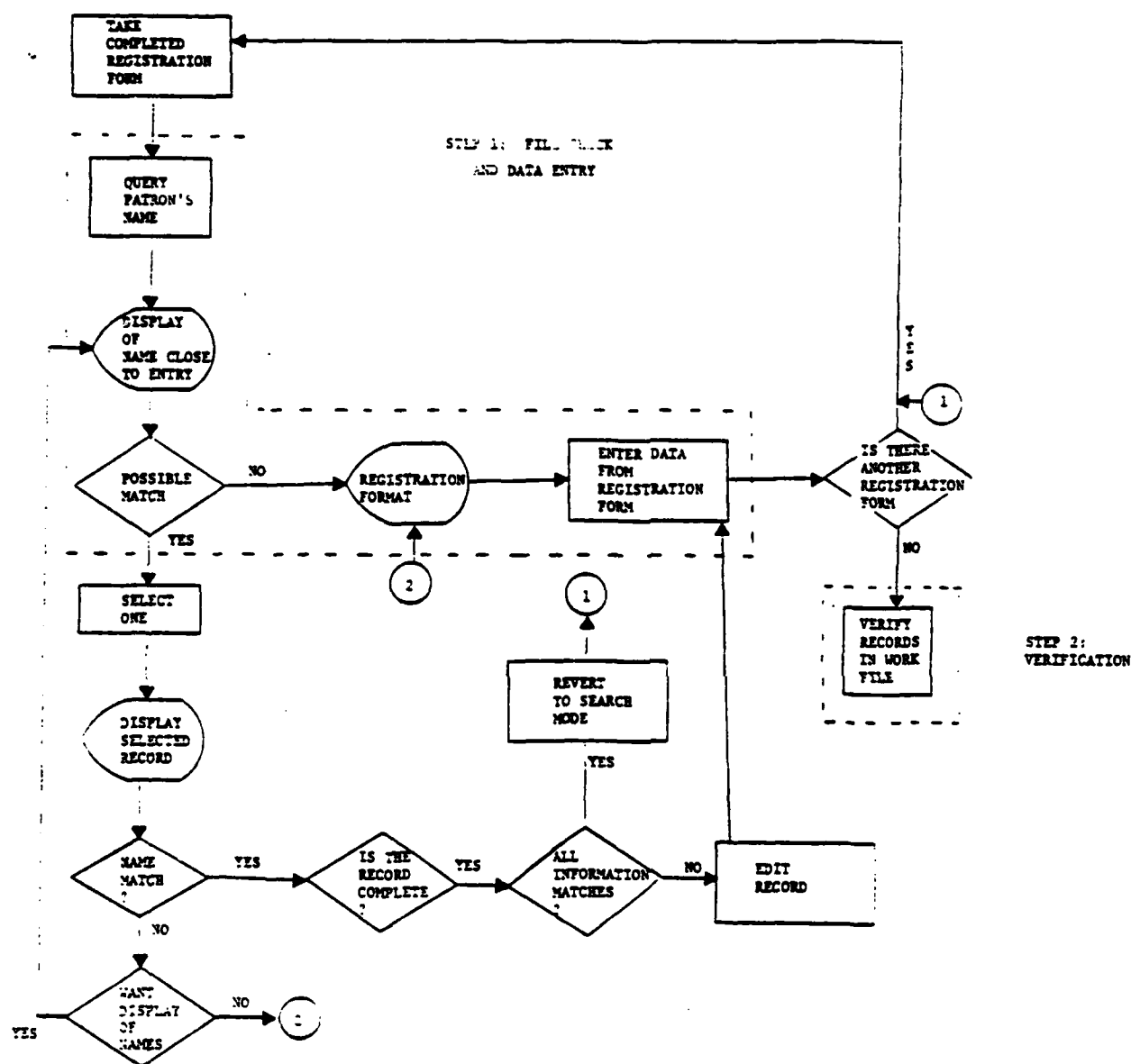


FIGURE 2
FLOWCHART SHOWING CREATION OF PATRON RECORD

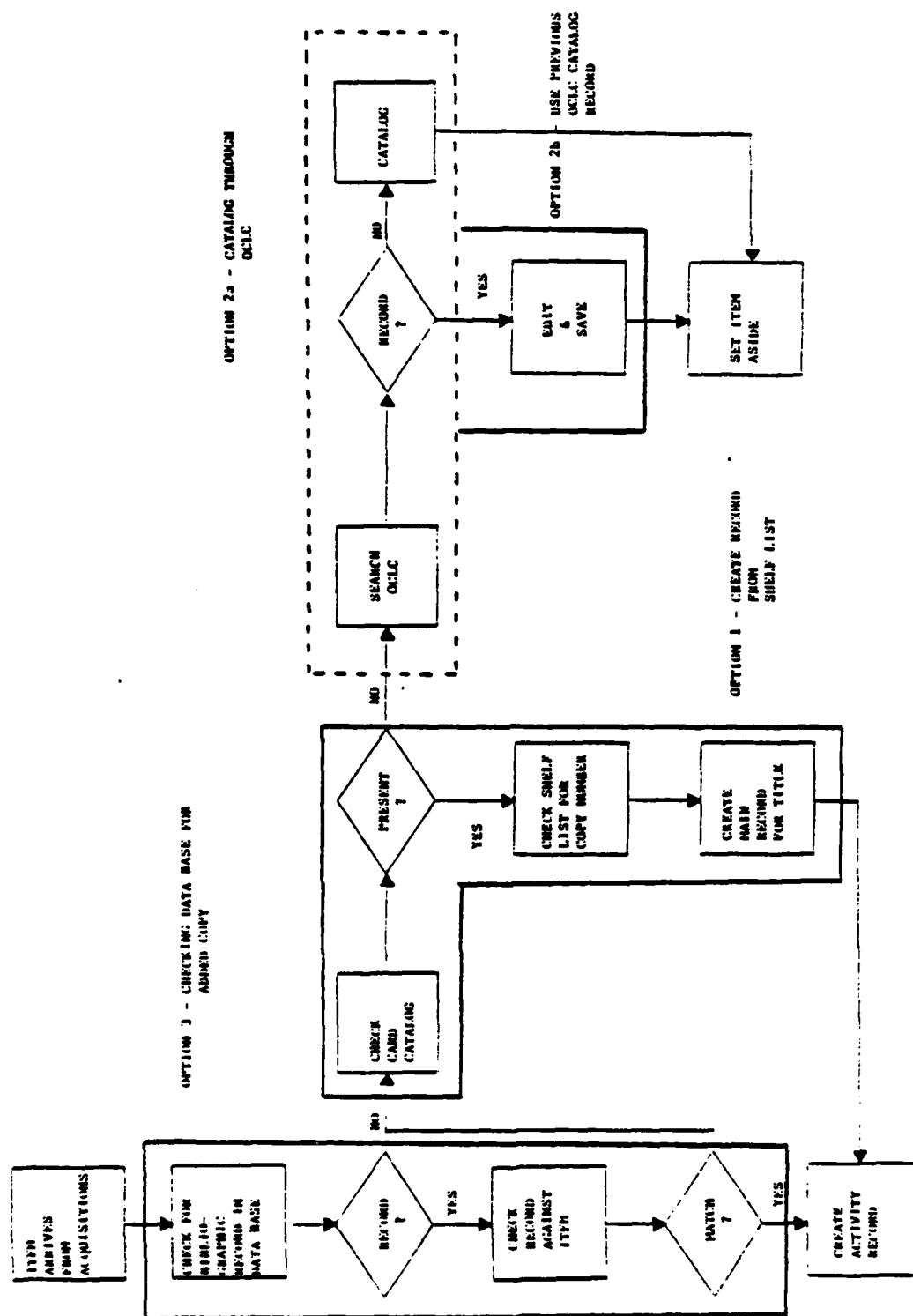


FIGURE 3
FLANAGAN SHOWING CREATION OF BIBLIOGRAPHIC RECORDS

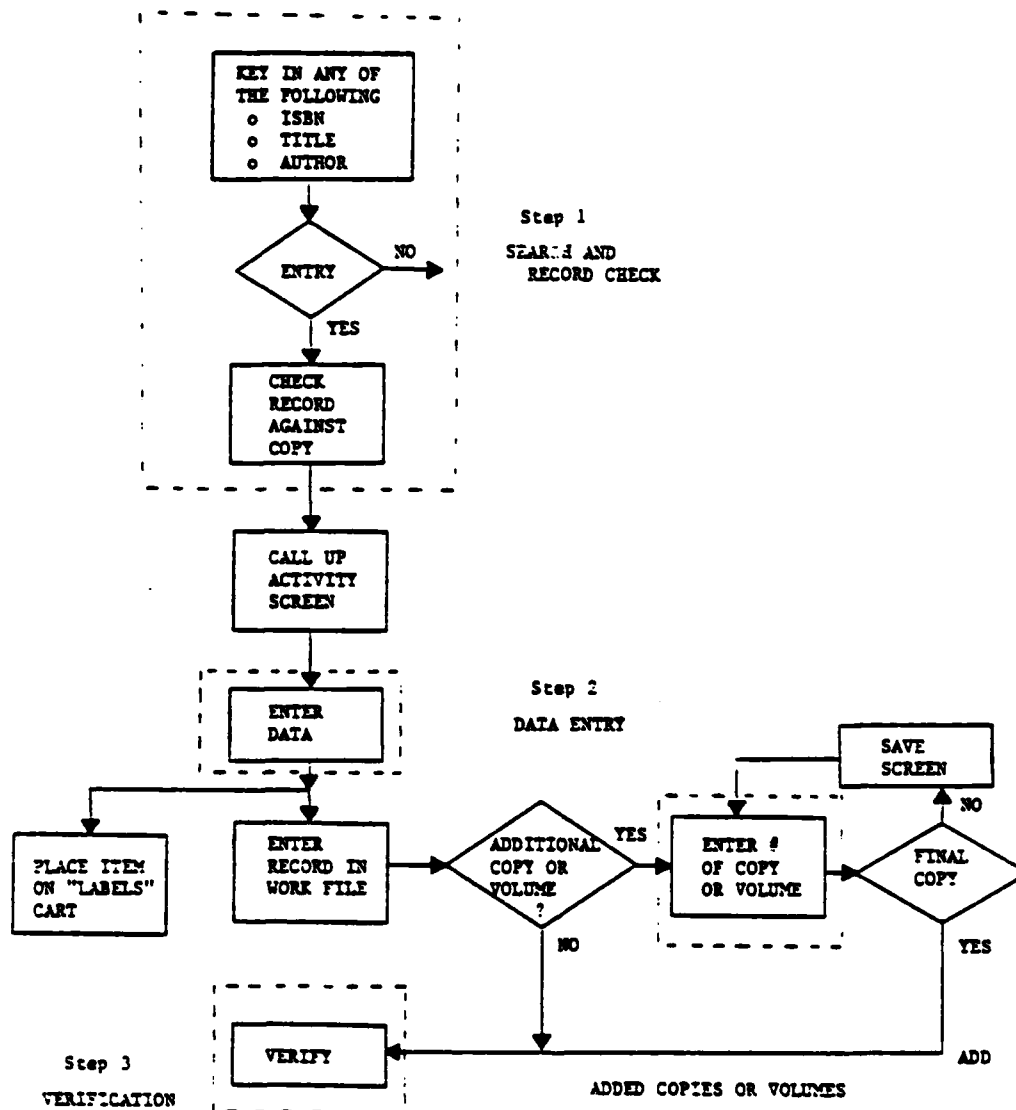


FIGURE 4
PROCESS OF CREATING AN ACTIVITY RECORD

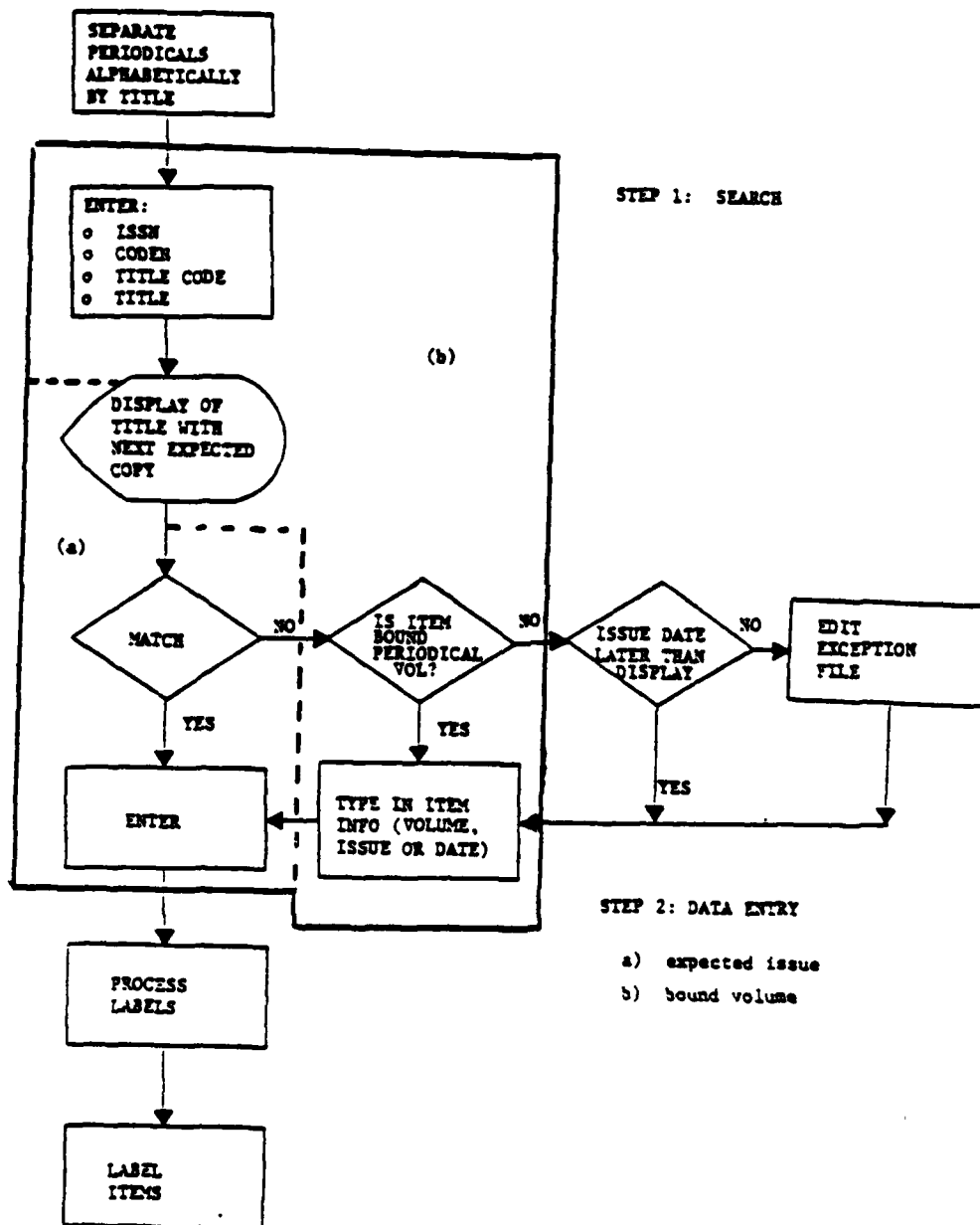


FIGURE 5
SERIALS CHECK-IN

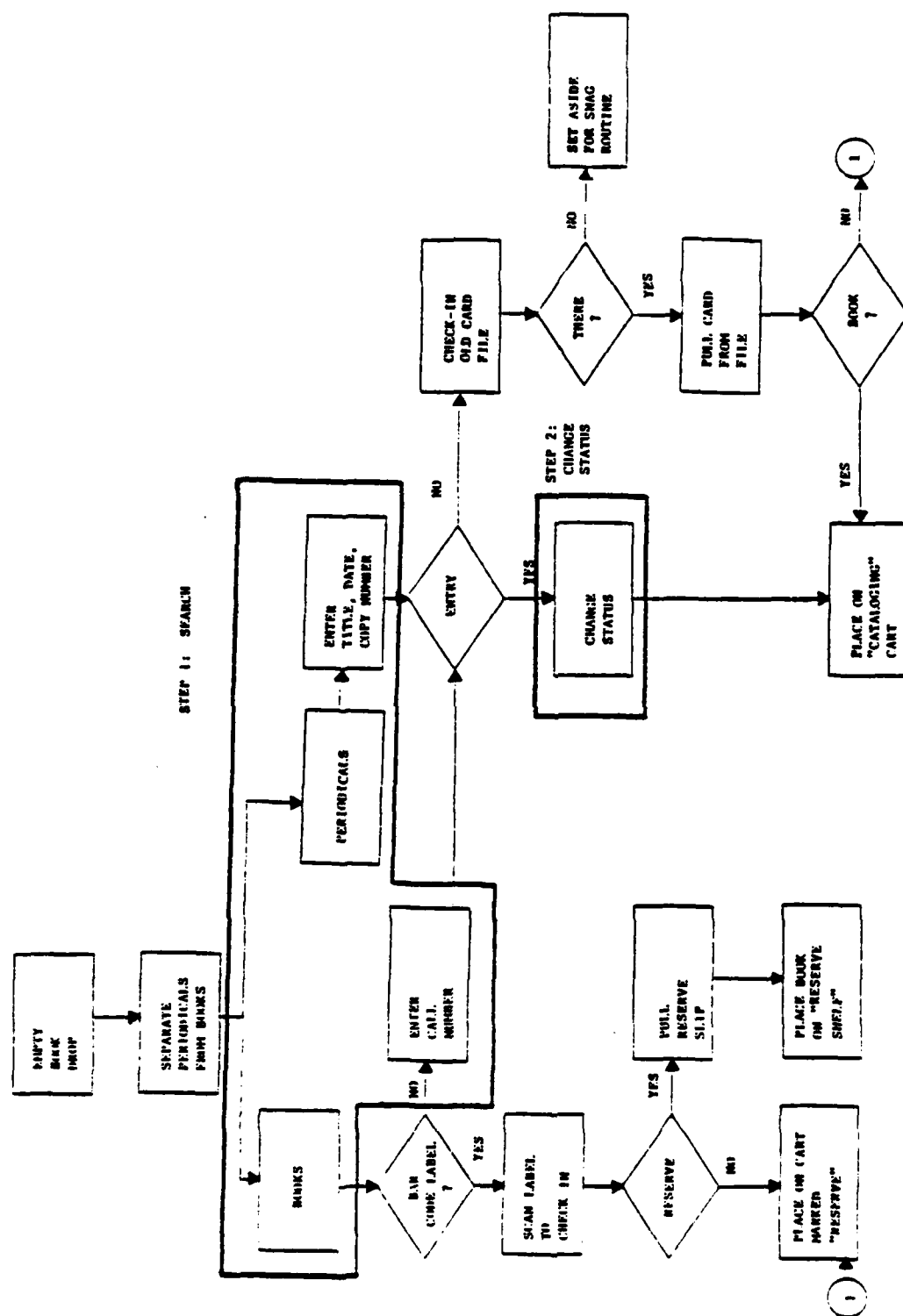


FIGURE 6
FLAMMART DEPICTING CHECK-IN OF UNLABLED ITEMS

Creating the criteria for record selection, record tag selection and substandard record rejection is a time-consuming procedure (estimated time—1 hour); however, it may be done only once per cataloger and then stored. Editing/verifying records will be a weekly activity.

2.4 Priority for Analysis

Record creation is the most time-consuming activity in the conversion process. In some instances there are alternative ways of creating a record; for example, a bibliographic record may be catalogued through OCLC, a previous record in OCLC may be captured, or data may be entered from the shelf list. Similarly, the creation of a record may vary in complexity. In comparison to monographs, serial titles or multivolume works require additional data. On the other hand, activity records for multivolume works (where only the volume number changes) should be more easily created. Because of the above, the primary emphasis of this study will be on collecting cost data for the various types of records under varying conditions of data entry, including the process of loading and editing the OCLC/MARC tapes.

A summary of conversion activities arranged in order of importance is given in Table II.

TABLE II
SUMMARY OF CONVERSION ACTIVITIES TO BE STUDIED

ACTIVITY	STEPS TO BE COSTED	VARIATIONS		
		PROCESS	TYPE	OTHER
Creation of Patron Record	1. File check & Data Entry 2. Verification	None	Regular Institutional Mixed	
Creation of a Bibliographic Record (limited to monographs)	1. Data Entry 2. Verification 3. Search	OCLC-Catalog OCLC-Capture Shelf List		
Creation of an activity record	1. Data Entry 2. Verification 3. Search		Monographs Serials Added volumes	
Produce Labels	(Computer connect time only)		Group of 3 (Items) 1 Label each (Patron)	
Label Items	1. Placement of Label			May include locating & reshelving
Check-In of unlabeled Items	1. Search 2. Clear			
Authority File Maintenance	1. Review 2. Edit			

3.0 COSTS

This section discusses the types of costs to be studied during the Army Library's conversion. These include labor, equipment and materials costs and OCLC/FEDLINK charges. Each of these is discussed in greater detail below and summarized in Table IV at the end of this section.

Equally important to note are the cost factors that will not be studied. These include any costs associated with site preparation, costs for training and development of training manuals and any charges from the Pentagon computer center for work they may perform.

3.1 Labor Costs

Labor costs are derived by determining the amount of time the library staff spends on conversion activities and multiplying that by the effective hourly rate for the category of worker performing that task. For the Army Library there are three categories of workers: professional staff, library technicians, and full-time clerical workers. A fourth category--temporary or part-time clerical workers, who are paid on a flat hourly basis--could be used to convert or enter records. The effective hourly rate will differ for each category of worker because of differences in salary; however, the basic formula will be the same.

To determine the effective hourly rate for a category of worker it is necessary to consider the total cost of salary (TCDS) and the total productive hours per year (TPHY) for the worker in that class. Total cost of salary for a worker equals salary or wages plus benefits.

Total Cost of Salary for Worker i (TCDS_i)
 $TCDS_i = \text{Salary}_i + \text{Benefits}_i$

Total productive hours per year (TPHY) are determined as follows:

$TPHY_i = \text{Hours per year} - \text{Average Vacation} - \text{Average Sick leave} - \text{Hours of Holiday per year.}$

Effective Hourly Cost of Annual Salary per Worker_i (EHCDAS_i)
 $EHCDAS_i = \frac{TCDS_i}{TPHY_i}$

The total effective hourly cost of annual salary for a category (TEHCDAS) is:

$$TEHCDAS = \frac{\sum_{i=1}^n TCDS_i}{\sum_{i=1}^n TPHY_i} \quad \text{where } n = \text{total number of employees in that category}$$

Thus, the labor cost for an activity will be dependent on the category of worker - professional or clerical - performing that task. To the extent that procedures can be simplified to permit non-professionals to perform these tasks, conversion costs can be lowered.

3.2 Equipment and Materials

The Army Library plans to use a Scanmark four-hammer printer to produce barcoded labels for both patron cards and items. Initially this will be leased; however, the library is considering purchasing if there are advantages to in-house printing.

For purposes of this study, the monthly charge for leasing the printer will be considered a conversion cost. If the Army Library later decides to buy the printer, that cost would be considered part

of the capital expenditure. The cost of this equipment is the fixed monthly fee divided by the number of units produced during the month. Thus, if only ten labels are produced during a month, the equipment factor in the unit cost will be the monthly fee divided by ten.

In addition to the cost of the barcode printer there are material costs associated with conversion. These include card stock for the pattern cards, Scanblock CSI (the printing medium), label stock and a laminate. The decision to use the laminate is not final.

Based on Markem's quotations these materials are priced as follows:

1 roll (900') CSI printing medium -----	\$3.75
1 roll (550') label stock (paper) -----	\$3.75
1 roll (216') laminate -----	\$2.40

Markem estimates a cost of .00528/label; however, this assumes every piece of label stock is printed and of acceptable quality. There is some wastage when the rolls are threaded and at the beginning and end of each batch that is printed. The weekly conversion reports will note this wastage as well as the number of labels rejected because of poor quality.

3.3 Computer Costs

The computer costs cannot be determined. Terminal connect time will be recorded for each batch and reported weekly. This time will, of course, be affected by the number of users on the system during the processing period.

3.1 OCLC and FEDLINK Charges

The Army Library shares cataloging with OCLC through the FEDLINK program. The library may choose to search the OCLC base for bibliographic data and copy OCLC records for their retrospective conversion. A summary of the relevant OCLC and FEDLINK charges is given in Table III.

Since the equipment for accessing the OCLC data base is already in place and will be used in day-to-day operations, no equipment charges or leased line costs will be attributed to conversion.

TABLE III
FEDLINK/OC LC CHARGES RELEVANT TO
CREATION OF BIBLIOGRAPHIC RECORDS

COST ELEMENT	UNIT COST	REMARKS
1. Tape, handling & delivery	\$25.76 per tape	
2. Credit for returned tape	6.00 per tape	
3. Copying charge per record:		
1-1,000 logical records	\$.039 per record	
1001-5,000 logical records	.014 per record	
5001-50,000 logical records	.0045 per record	
over 50,000 logical records	.001 per record	
4. Search (per search key)	\$.025 per search	There is a \$2,554 maximum charge per terminal per year

TABLE IV
SUMMARY OF COSTS FOR CONVERSION ACTIVITIES

ACTIVITY	COSTS					FEDLINK
	LABOR	EQUIPMENT	COMPUTER	MATERIAL		
Creation of bibliographic record: (a) shelf list (b) through OCLC	Professional Technician Same as above	None	Connect Time	None	None	None
	Same as above	None	None	None	None	Charge per logical record
	Tape Processing	Same as above	None	Connect Time	None	
Creation of an activity record	Same as above	None	Connect Time	None	None	None
Creation of patron records	Professional Technician Clerical	None	Connect Time	Registration Card	None	None
Produce labels		Barcode printer	Connect Time	Medium Label Tape Laminate	None	None
Labeling an item	Technician	None	None	Label (Cost derived from above)	None	None
Check-in of unlabeled items (a) Query (b) Clearing	Technician	None	Connect Time	None	None	None
Creation of authority file	Professional	None	Connect Time	None	None	None
Maintenance of authority file	Professional	None	Connect Time	None	None	None

4.0 COLLECTION OF COST DATA

Cost information on use of materials and equipment, as well as terminal connect time, will be collected throughout the conversion period. The primary concern, however, is the collection of accurate data on labor costs. This section describes how the data will be collected.

4.1 Cost Data on Materials

As noted in section three, there will be barcoded labels that will not be used either because they were misprinted or because the books have spine labels already. (The printer will produce three labels for each book - one for the back inside cover, one for inside front, and a third for the spine or front cover.) Unused labels will be placed in a box located in the computer room and checked daily. Particular attention will be given to data on rejected labels at the beginning and end of the printing ribbon. Once the number of wasted labels has been measured and factored in, a price per label can be determined that will be more realistic than the \$.00528/label estimated by Markem.

4.2 Computer Connect Time

This will be recorded on the Lister Hill computer. If this is not a significant cost, it may not be collected once the Army Library begins using its own computer.

4.3 Equipment Costs

The cost of the barcode printer, as discussed in section three, is a fixed cost per month. In determining unit costs for items this fee will be divided by the number of items processed.

4.4 OCLC/FEDLINK Charges

The cataloging section will be asked to keep a tally of how many titles were originally cataloged (no charge) and how many records were captured from OCLC. This can be checked against the weekly tapes and OCLC/FEDLINK billing if necessary. The fixed cost of the weekly tape minus the refund will be divided by the number of items cataloged on it to produce a per unit cost. This would be in addition to any charge per logical record or per search.

4.5 Labor Costs

There are several ways to collect labor costs. One method would be to ask the employees how they divide their time among various tasks and match this with a volume count to produce a unit cost. Another possibility would require employees to record the time spent on a specific task as they perform it. A third method requires an observer to record the time per task using a stop watch. Because of previous difficulties using survey techniques in the Army Library the stop watch method will be used. The remainder of this section discusses which workers will be observed and how the work will be sampled.

4.4.1 Personnel

Table V shows the number and type of worker assigned to each task. During the period of study each worker will be observed and timed. There should not be much variation in times with the exception of one task - creating bibliographic records. Nevertheless, records will be kept for individual workers.

TABLE V
ASSIGNMENT OF ARMY LIBRARY PERSONNEL TO CONVERSION TASKS

CONVERSION TASK	NUMBER OF PERSONNEL ASSIGNED		
	PROFESSIONAL	TECHNICIAN	CLERICAL
Creation of Patron Records	1	2	1
Serials Check-In		1*	
Creation of Bibliographic Records	2		
Creation of Activity Records		3 (positions currently vacant)	
Creation of Law Records (Bibliographic and Activity)	1	1	
Labeling		3	
TOTAL STAFF	4	8**	1

* Two additional people will be trained as backup.

** Total reflects staff assigned to more than one conversion task.

4.4.2 Work Samples

Since Lister Hill seeks information on the unit cost by type of item and since the conversion procedures have been designed to batch similar items, the work samples studied will be homogeneous. Although patrons may be classified as regular, institutional or special, the batch of patron records need not be composed of one type. Therefore, entry of both homogeneous and mixed groups of patron records will be studied. Figure 7 is a typical form for recording labor costs.

4.4.3 Frequency of Samples

Each week during the conversion period at least one time study will be made and reported to Lister Hill. These will be taken at different times of the day if the activity occurs throughout the work day.

DATE:
TIME OF DAY:
OPERATOR:

OPERATION	SAMPLE			CLOCK TIME IN SECONDS			COMPUTER CONNECT TIME		COST* PER UNIT		
	SIZE	TYPE**		BATCH	MIN.	MAX.	BATCH	APPOINTED PER UNIT	MIN.	MAX.	AVG.
		H.	M.								
ACTIVITIES & SUBACTIVITIES											
EXAMPLE: Create activity record											
(a) Query											
(b) Enter data											
(c) Verify											

* Cost reflects only labor.
** Type refers to homogeneous or mixed sample.

FIGURE 7
FORM FOR RECORDING LABOR AND COMPUTER
CONNECT TIME CREATION OF RECORDS

5.0 FACTORS AFFECTING COSTS

As noted in Section 4.0, cost information will be gathered throughout the period of conversion. It is expected that unit costs will vary from week to week. Several factors account for the variation including the following:

- learning curves on conversion tasks
- changes in procedures
- inefficient use of the equipment

Each of these are discussed below.

5.1 Learning Curves

As the library staff becomes familiar with procedures, the terminal and the entry screens, the time required to perform a task should decrease. These changes will be tracked.

5.2 Changes in Procedures

Although procedures for the Army Library have been described and flowcharted in collaboration with the library staff, these will be modifications over the period of conversion. If changes are substantial, and particularly if the time required to complete tasks is altered, the costs will vary. To avoid comparison of dissimilar activities, cost data must note any change in the activity and be kept separate.

5.3 Inefficient Use of the Equipment

Inefficient use of the barcode printer will result in a high per unit cost as noted in Section 3.0. To compensate for this, costs will be reported in separate categories for labor, material and equipment and then aggregated.

6.0 SUMMARY

The cost study then will focus on developing unit costs of key conversion activities. These activities have been identified and significant variations in processing and type of material noted in Table II. Unit costs for the creation of bibliographic, activity and patron records are to be studied most intensively. Tape processing will also be closely monitored.

Labor, material and equipment costs must be collected in order to derive a unit cost. There are also OCLC/FEDLINK charges incurred for some bibliographic records. Table IV gives a summary of the costs for each conversion activity. The labor cost, which is the most important element, will be determined by clocking the amount of time a staff member takes to complete a task. This time will be matched against the effective hourly rate for the category of worker (professional, technician or clerical).

Cost information will be reported to Lister Hill in weekly reports on the conversion and included in the project's final report. The content and format of each of these is explained in greater detail below.

6.1 Weekly Reports

The weekly report on conversion will include information on costs. This will be essentially raw data. The report will identify the following:

- the activity surveyed
- the size and number and composition of the samples. (If several workers are studied, this will be indicated as well.)

- the time to complete the task either in terms of the batch or per unit
- If there are variations in the time to complete a task, a minimum/maximum time will be reported.
- Unit costs will reflect each component cost (labor, equipment, material as applicable) so that more accurate comparison can be made.
- Any deviations attributable to changes in staff or procedures or to the complexity of the items processed will be noted.

6.2 Final Report

The final report on the Army Library's conversion to the ILS will summarize the weekly data. This will be either in a series of tables or graphs as appropriate. In addition, the final report will show the learning curve. Where alternate procedures have resulted in differences in costs these will be noted.

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